UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE STORAGE FACILITY
(No.)

Code 313

DEFINITION

A waste impoundment made by constructing an embankment and/or excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To temporarily store wastes such as manure, dry poultry litter, wastewater, and contaminated runoff as a function of an agricultural waste management system.

CONDITIONS WHERE PRACTICE APPLIES

The storage facility is a component of a planned agricultural waste management system.

Temporary storage is needed for organic wastes generated by agricultural production or processing.

The storage facility can be constructed, operated, and maintained without polluting air or water resources.

Soils, geology, and topography are suitable for construction of the facility.

The practice applies to facilities utilizing embankments with an effective height of 35 feet or less where damage resulting from failure would be limited to damage of farm buildings, agricultural land, or township, and country roads. Fabricated structure facilities apply to tanks, stacking facilities, and pond appurtenances.

CRITERIA

Federal, State, and Local Laws. All planned work shall comply with all federal, state, and local laws and regulations. The Alabama Department of Environmental Management (ADEM) Rules require owners/operators of animal feeding operations (AFOs) and associated waste management systems to fully implement and regularly maintain effective best management practices (BMPs) that meet or exceed NRCS technical standards and guidelines to prevent discharges and to ensure groundwater and surface water quality. AFO owners/operators who fail to implement BMPs or whose facilities discharge or will discharge to "waters of the state" can be required by ADEM or the Environmental Protection Agency to implement effective corrective actions immediately. If preventive or effective actions are not fully implemented in a timely manner, civil penalties may be incurred by the owners/operators.

Storage Period. The storage period is the maximum length of time anticipated between emptying events. The minimum storage period shall be determined so as to prevent surface or groundwater pollution and be based on the timing required for environmentally safe waste utilization considering the climate, crops, soil, equipment, management, and local, state, and federal regulations. The minimum storage period shall be thirty (30) days for all methods of disposal except milk parlor waste that is conveyed with sprinkler irrigation shall have a minimum storage period of seven (7) days.

Design Storage Volume. The design storage volume shall consist of the total of the following as appropriate:

a. Manure, wastewater, and other wastes accumulated during the storage period.

b. If the facility is uncovered, normal precipitation less evaporation on the surface area of the facility during the storage period.

NRCS, Alabama
December 2001

c. Normal runoff from the facility's drainage area during the storage period.

d. If the facility is uncovered, 25-year, 24-hour storm precipitation on the surface of the facility and storm runoff from the facility's drainage area, if any. (See requirement for minimum depth in Emergency Spillway section.).

e. 25-year, 24-hour storm runoff from the facility's drainage area.

f. Residual solids after liquids have been removed.

g. Additional storage as may be required to meet management goals or regulatory requirements.

The design storage volume for a water storage facility is equal to its required volume.

Inlet. Inlets shall be of any permanent type designed to resist corrosion, plugging, and freeze damage incorporating erosion protection as necessary.

Safety. Designs shall include appropriate safety features to minimize the hazards of the facility.

Protection. To control erosion, embankments, and disturbed areas surrounding the facility shall be vegetated according to NRCS conservation practice standard, Critical Area Planting, Code 342.

Flexible Membranes. Flexible membranes shall meet or exceed the requirements of flexible membrane linings as specified in NRCS conservation practice standard, Pond Sealing or Lining (Flexible Membrane), Code 521A.

Location. Waste storage facilities, if located within floodplains, shall be protected from inundation or damage from a 25-year, 24-hour storm event.

Waste storage facilities shall be located as close to the source of waste and as far from neighboring dwellings or other areas of public use as practical and as allowed by federal, state, and local laws.

Safety Provisions. Entrance ramps shall be designed for safe entrance based on the type of equipment used. Warning signs, ladders, ropes, bars, rails, and other devices shall be provided, as appropriate, to ensure the safety of humans and livestock.

Ventilation and warning signs must be provided for covered waste holding structures, as necessary, to prevent explosion, poisoning, or asphyxiation.

Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices to control gas entry into the buildings.

Additional Criteria for Waste Storage Ponds

Hazard Classification. The area downstream of the embankment must be evaluated carefully to determine the impact a sudden breach of the proposed embankment would have on both structural and environmental features and to public safety. (See Considerations.) This evaluation must consider all improvements and those improvements that may reasonably be expected to be made during the useful life of the structure. The results of this examination provides for the proper hazard approval classification of the embankment. Only hazard class (a) embankments are to be designed under this standard. See National Engineering Manual Part 520.21 for guidance concerning documentation of hazard class determination.

Soils and Foundation. A detailed soils investigation with special attention to the water table depth and potential seepage problems must be considered in each design. Soil investigations must evaluate soils to a depth no less than two feet below the final grade of any excavation. The pond shall be located in soils with acceptable permeability, or the pond shall be lined.

Information and guidance on controlling seepage from waste storage ponds can be found in the Agricultural Waste Management Field Handbook (AWMFH), Chapter 7.

Liners. Liners shall be designed and constructed in accordance with the NRCS

conservation practice standard, Waste Treatment Lagoon, Code 359.

Waste storage ponds constructed in high water table soils. Waste storage ponds constructed in high water table soils will be considered only as a last site alternative and shall be based on a detailed risk assessment. The risk assessment shall include an analysis of the potential for ground water pollution considering the hydrogeology, ground water transmissivity, soil permeability, etc. Decisions to install waste storage facilities in high water table soils without liners must provide reasonable assurances that the facility will not cause surface or ground water pollution.

If during the risk assessment, it is determined that the site is a potential hazard to ground water pollution, it shall be designed with a liner to prevent contamination of ground water. Methods to maintain the liner integrity shall be considered in the design.

Storage volume for waste storage ponds constructed in high water table soils shall be the volume above the natural high water level elevation.

Inlet. Inlets may be push-off ramps, paved slopes, or pipe inlets.

Paved slopes shall be no flatter than 4 horizontal to 1 vertical (4:1) and will not be used when appreciable bedding materials are used.

Pipe inlets may be concrete, aluminum, or PVC as required in NRCS conservation practice standard, Pond, Code 378.

All pipes shall be designed to carry the required flow and shall be installed on a slope of 1 percent or greater and preferably 1.5 percent or greater. Where solids are being conveyed, the pipe diameter shall be sized to prevent plugging. Minimum pipe diameter will be 6 inches.

Pumped inlets shall be sized to meet the requirements of the pumping equipment. The slope of the pond at the pipe outlet shall be protected from erosion by paving or by extending the pipe outlet to a point where the discharge will not fall on the slope. Permanent measures shall be used to protect liners during initial filling and after periodic emptying. Pipes shall be supported on pilings of pressure treated wood, steel, concrete, or masonry and anchored to prevent dislodging or flotation.

Larger diameter gravity loading pipes for solids and liquids shall outlet at the bottom of the pond, and the effective head (vertical difference between the top of drop inlet and the design volume elevations) shall be no less than 4 feet.

Embankments. The minimum elevation of the top of the settled embankment shall be 1 foot above the required storage volume for waste storage pond without emergency spillways, and 1 foot above the design depth of flow in the emergency spillway for a storage pond with emergency spillways. This height shall be increased by the amount needed to ensure that the embankment top elevation will be maintained after settlement. This increase shall be not less than 5 percent.

The minimum embankment top width shall be as shown in Table 1. If the embankment top is to be used as a road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guard rails or other safety measures shall be used where necessary. When the embankment top is used as a road, provisions shall be made for protecting the emergency spillway from damage.

Table 1. Embankment Top Width

Total Height of Embankment, Feet	Minimum Top Width, Feet
<15	8
15 to 20	10
>20 to 25	12
>25 to 35	14

The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical (5:1), and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1). All slopes must be designed to be stable. Where

embankments are to be mowed; 3 horizontal to 1 vertical (3:1) or flatter slopes are recommended.

Compaction of the embankment fill material shall be in accordance with the specified design requirements for compaction and moisture content. As a minimum compaction shall be equivalent to, or better than, the following:

1. Layers of fill shall not exceed 8 inches in thickness before compaction. Compaction shall be accomplished by routing the hauling and spreading equipment over the fill in such a manner that every point on the surface of each layer of fill will be traversed by not less than complete passes of the loaded equipment traveling in a direction parallel to the main axis of the fill.

2. Clayey soils shall be compacted with a "sheepfoot" or tamping roller. (See NEH 651, Agricultural Waste Management Field Handbook, Appendix 10D, for guidance on compaction.)

Excavated Ponds. Side slopes shall be stable and shall not be steeper than 2 horizontal to 1 vertical (2:1). A low embankment shall be constructed to prevent surface runoff from entering the pond. The embankment shall meet the criteria contained in the section Embankments, of this standard.

Outlet. No outlet shall automatically release storage from the required storage volume. Manually operated outlets shall be of permanent type designed to resist corrosion and plugging.

Emergency Spillway. An emergency spillway, combination of spillways, or additional storage shall be provided to protect the waste storage pond from overtopping when a 25-year, 24-hour storm event is exceeded. The crest of the emergency spillway shall be located at or above the top of the 25-year, 24-hour storm storage. The depth added to the waste storage pond to contain the 25-year, 24-hour storm volume shall be a minimum of 1 foot. The emergency spillway shall be designed to pass a 25-year, 24-hour storm while maintaining a minimum of 1 foot of freeboard above the designed depth of flow in the emergency spillway. Emergency spillway requirements, however, do not apply to waste storage ponds without drainage areas and with less than 3 feet of storage above natural ground.

The emergency spillway shall be placed in undisturbed soil when possible. When it must be placed in fill material, precautions shall be taken to insure the integrity of the structure. Where a waste storage pond empties into another waste storage pond and the liquid level is positively controlled by an adequately sized overflow pipe, no emergency spillway is required for the primary waste storage pond.

Pipe emergency spillways shall be 6-inch minimum diameter and equipped with trash racks, antivortex devices, and antiseep collars as required in NRCS conservation practice standard, Pond, Code 378. Pipes may be steel, concrete, aluminum, or PVC as required in NRCS conservation practice standard, Pond, Code 378.

Emptying Facilities. Some type of facility shall be provided for emptying the pond. Ramps used to empty liquids shall have a slope of 4 horizontal to 1 vertical (4:1) or flatter. Ramps used to empty slurry, semi-solid, or solid waste shall have a slope of 10 horizontal to 1 vertical (10:1) or flatter. Steeper slopes may be used if special traction surfaces are provided.

Where agitators are used in ponds with liners, the tip of the propeller shall be a minimum of 3 feet from the liner surface or the liner shall be protected by a concrete pad.

Provision shall be made for periodic removal of accumulated solids to preserve storage capacity. The anticipated method for doing this must be considered in planning, particularly in determining the size and shape of the pond and type of seal, if any.

Waste removed from storage facilities shall be utilized in accordance with NRCS conservation practice standard, Nutrient Management, Code 590.

Staff Gage. A staff gage or other permanent marker shall be placed in the waste storage pond to clearly indicate the maximum level of storage allowed to accumulate before emptying must be initiated. The marker shall indicate the

level at which sufficient storage remains to contain the 25-year, 24-hour runoff and precipitation.

Safety. The pond shall be fenced according to NRCS conservation practice standard, Fence, Code 382, with safety as the objective. **"WARNING"** signs shall be posted to deter anyone from using the facility for anything other than its intended purpose. A **"WARNING"** sign (90 in^2 minimum) shall be placed on each straight section of fencing, not to exceed a spacing of 300 feet.

Additional Criteria for All Fabricated Structures

Service Life and Durability. Planning, design, and construction shall ensure that the structure is sound and of durable materials commensurate with the anticipated service life, initial and replacement costs, operation and maintenance, costs, and safety and environmental considerations.

Guidance in evaluating the service life of various materials is given in Table 2. The materials indicated meet the requirements of this standard. The service life of materials not shown shall be based on performance data.

Table 2. Service Life of Various Materials

Service life	Material[1/]
Short (minimum of 10 years)	Wood; masonry, including concrete staves; flexible membranes; glass/fiber reinforced plastics/resins; steel coated with zinc, epoxy, vinyl, and asphalt; reinforced concrete.
Medium (minimum of 20 years)	Reinforced concrete; glass fused steel.
Long (minimum of 50 years)	Reinforced concrete; flexible membranes with earth covers.

[1/] The durability and estimated life of reinforced concrete is a function of the design criteria and the quality of the concrete. A key aspect affecting durability is corrosion of the reinforcement which is directly related to cracking (design stress) and the reinforcement cover.

Foundation. The foundations of fabricated waste storage facilities shall be proportioned to safely support all superimposed loads without excessive movement or settlement.

Where a non-uniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, settlement should be calculated from site specific soil test data. Index tests of site soil may allow correlation with similar soils for which test data is available. If no test data is available, presumptive bearing strength values for assessing actual bearing pressures may be obtained from Table 3 or another nationally recognized building code. In using presumptive bearing values, adequate detailing and articulation shall be provided to avoid distressing movements in the structure.

Structure Loading. Waste storage structures shall be designed to withstand all anticipated loads including internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, water pressure due to seasonal high water table, and frost or ice pressure and load combinations in compliance with this standard and applicable local building codes.

Table 3. Presumptive Allowable Bearing Stress Values[1/]

Foundation Description	Allowable Stress
Crystalline Bedrock	12000 psf
Sedimentary Rock	6000 psf
Sandy Gravel or Gravel	5000 psf
Sand, Silty Sand, Clayey Sand, Silty Gravel, Clayey Gravel	3000psf
Clay, Sandy Clay, Silty Clay Clayey Silt	2000 psf

[1/] Basic Building Code, 12th Edition, 1993, Building Officials and Code Administrators, Inc. (BOCA)

The lateral earth pressures should be calculated from soil strength values determined from the results of appropriate soil tests. Lateral earth pressures can be calculated using the

procedures in Technical Release (TR) - 74. If soil strength tests are not available, the presumptive lateral earth pressure values indicated in Table 4 shall be used.

Lateral earth pressures based upon equivalent fluid assumptions shall be assigned according to the structural stiffness or wall yielding as follows:

Rigid frame or restrained-wall. Use the values shown in Table 4 under the column "Frame Tanks", which gives pressures comparable to the at-rest condition.

Flexible or yielding wall. Use the values shown in Table 4 under the column "Freestanding Wall", which gives pressures comparable to the active condition. Walls in this category are designed on the basis of gravity for stability or are designed as a cantilever having a base wall thickness to height of backfill ratio not more than 0.085.

Table 4. Lateral Earth Pressure Values 1/

Soil		Equivalent fluid pressure			
		Above Seasonal High Water Table 2/		Below Seasonal High Water Table 3/	
Description 4/	Unified Classification 4/	Free-standing Walls	Frame Tanks	Free-standing Walls	Frame Tanks
Clean gravel, sand, or sand-gravel mixtures (maximum 5% fines) 5/	GP,GW,SP,SW	30	50	80	90
Gravel, sand, silt, and clay mixtures (less than 50% fines) Course sands with silt and/or clay (less than 50% fines)	All gravel/sand dual symbol classifications and GM, GC, SC, SM, SC-SM	35	60	80	100
Low plasticity silts and clays with some sand and/or gravel (50% or more Fines) Fine sands with silt and/or clay (less than 50% fines)	CL, ML, CL-ML, SC, SM, SC-SM	45	75	90	105
Low to medium plasticity silts and clays with little sand and/or gravel (50% or more fines)	CL. ML, CL-ML	65	85	95	110
High plasticity silts and clays (liquid limit more than 50) 6/	CH, MH	-	-	-	-

1/ For lightly compacted soils (85% to 90% maximum standard density.) Includes compaction by use of typical farm equipment.
2/ Also below seasonal high water table if adequate drainage is provided.
3/ Includes hydrostatic pressure.
4/ All definitions and procedures in accordance with ASTM D 2488 and D 653.
5/ Generally, only washed materials are in this category.
6/ Not recommended. Requires special design if used.

Internal lateral pressure used for design shall be 65 lbs/ft^2 where the stored waste is not protected from precipitation. A value of 60 lbs/ft^2 may be used where the stored waste is protected from precipitation and will not become saturated. Lesser values may be used if supported by measurement of actual pressures of the waste to be stored. If heavy equipment will be operated near the wall, an additional two feet of soil surcharge shall be considered in the wall analysis.

Structural Design. The structural design shall consider all items that will influence the performance of the structure, including loading assumptions, material properties, and construction quality. Design assumptions and construction requirement shall be indicated on the plans.

Minimum requirements for fabricated waste storage structures are as follows:

Steel. "Manual of Steel Construction", American Institute of Steel Construction.

Timber. "National Design Specifications for Wood Construction", American Forest and Paper Association. All lumber in contact with the ground or compost shall be pressure-treated in accordance with Federal Specification, Wood Preservation: Treating Practices, TT-W-571i.

Concrete. "Building Code Requirements for Reinforced Concrete, ACI 318", American Concrete Institute.

Masonry. "Building Code Requirements for Masonry Structures, ACI 530", American Concrete Institute.

Concrete Slabs on Grade. Slab design shall consider the required performance and the critical applied loads along with both the subgrade material and material resistance of the concrete slab. Where applied point loads are minimal and liquid-tightness is not required, such as barnyard and feedlot slabs subject only to precipitation, and the subgrade is uniform and dense, the minimum slab thickness shall be 4-inches with a minimum joint spacing of 10 feet. Joint spacing can be increased if steel reinforcing is added based on subgrade drag theory.

For applications where liquid-thickness is required such as floor slabs of storage tanks, the minimum thickness for uniform foundations shall be 5 inches and shall contain distributed reinforcing steel. The required area of such reinforcing steel shall be based on subgrade drag theory as discussed in industry guidelines such as American Concrete Institute, ACI 360, Design of Slabs-on-Grade.

When heavy equipment loads are to be resisted and/or where a non-uniform foundation cannot be avoided, an appropriate design procedure as described in ACI 360 shall be used.

If the facility is to have a roof, wind loads shall be as specified in ASAE EP288.5, Agricultural Building Snow and Wind Loads. If the facility is to serve as part of a foundation or support for a building, the total load shall be considered in the structural design.

Additional Criteria - Holding Tank

Holding tanks are used for liquid and slurry waste and may be open or covered, inside or outside of enclosed housing, or beneath slotted floors. Holding tanks shall be essentially watertight.

Depending on the hazard involved to the environment, tanks shall be constructed of reinforced masonry, coated or glass-fused steel or reinforced concrete. Tanks designed as buried structures shall have exterior drainage or a minimum safety factor of 1.3 against uplift, when empty.

Holding tanks shall be sufficiently watertight to retain liquids required for agitating and pumping and to function as planned. Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on the designed holding capacity shall be prevented by watertight construction or site drainage.

Tanks may be designed with or without covers. Covers, beams, or braces that are integral to structural performance must be indicated on the construction drawings. The openings in covered

holding tanks shall be designed to accommodate equipment for loading, agitating, and emptying, and shall have grills or secure covers for safety, odor, and vector control. Central loading from an elevation at or above the top of the sidewall of open holding tanks allows more complete and uniform filling, particularly with manure containing bedding. Steel and other corrodible materials shall be adequately protected with concrete, paint, or other protective coatings to prevent corrosion.

Tank covers shall be designed to withstand both dead and live loads. The live load values for covers are contained in ASAE EP378.3, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASAE EP393.2, Manure Storages, shall be the minimum used. The actual axle load for tank wagons having more than a 2,000 gallon capacity shall be used.

All structures shall be underlain by free draining material.

A minimum of 6 inches of residual solids storage shall be provided for tanks.

Additional Criteria - Stacking Facilities

Solids stacking implies that the manure has a consistency that does not flow, but remains in place even during the wettest time of the storage period. Facilities receiving 100 percent of the manure production, with no provision for liquid separation, shall not be designed as stacking facilities.

Stacking facilities may be open or roofed and are used for wastes which behave primarily as a solid. The anticipated stacking angle of manure must be considered in determining the wall height.

Stacking facilities shall be constructed of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. They shall be designed with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure. Lumber shall not be used for walls which support moving stacking elevators or similar loads.

Structural design criteria for stacking facilities shall be in accordance with the criteria for the various materials listed in the section "Structural Design" of this standard.

Floor Slabs and Walls. Floors shall slope away from the entrance. Suggested grade of the floor is 0.2 or 0.3 percent.

Timber Walls. All posts and lumber in contact with wastes or exposed to moisture shall be pressure-treated in accordance with Federal Specification, Wood Preservation: Treating Practices, TT-W-571i. Posts shall have a minimum size of 4 inch by 6 inch (nominal) and be placed in the ground from 3 to 6 feet deep, depending on the design analysis. Posts for "mini-composters" shall have a minimum size of 4 inch by 4 inch (nominal). Side planking shall be treated lumber with a minimum thickness of 2 inches (nominal).

Seepage. Effluent seepage in amounts that would pollute surface or ground water shall be prevented by watertight construction or collected and disposed of in a safe manner. Influent seepage in amounts that would infringe on designed storage capacity shall be prevented by watertight construction or site drainage.

Internal Drainage. Drainage of some liquids, including rainfall from the stacking area (especially those without a roof), should be considered. This is best accomplished by use of a timber wall with the boards installed vertically, leaving 3/4 inch cracks. The timber wall drainage section may be included in a concrete or masonry block wall. Design criteria shall be the same as for timber walls. Seepage shall be collected in a tank or waste storage pond, or properly treated in a lagoon or infiltration strip.

Poultry Litter Stacking Facilities. To prevent spontaneous combustion, poultry litter in the stacking facility should have less than 40 percent moisture and dry litter and moist litter should not be layered. In addition, the height of the litter stack shall not exceed 5 to 7 feet, with litter to wood contact limited to 3 to 5 feet.

Design procedures for poultry litter stacking facilities are contained in the Alabama Poultry Waste Management - Waste Utilization and Facility Design Workbook.

CONSIDERATIONS

Location. Waste storage facilities should be located as close to the source of waste and polluted runoff as practicable. In addition, they should be located considering prevailing winds and landscape elements such as building arrangement, landform, and vegetation to minimize odors and visual resource problems.

It is highly recommended that waste storage facilities meet the minimum distance requirement from public or private facilities as shown in Table 5.

Table 5. Minimum Distance Requirement for Waste Storage Facilities

Public or Private Use Facilities	Minimum Distance from Waste Storage Facility
Any public use area, church, picnic area, playground, etc.	700 feet
Residence or place of habitation other than owner or tenant.	700 feet
Well, up-gradient	100 feet - dry 150 feet - liquid
Well, down-gradient	300 feet
Natural Water Courses	200 feet
Milking Parlor	100 feet
Drainage Ditches	100 feet
Area specified by state or local ordinance	Greater of state or local distance or distance shown above

Solids Separation. To minimize frequency of solids removal from waste storage ponds, route polluted runoff through vegetative filter strips, low-gradient channels, or debris basins to remove readily settleable solids. Settling facilities should have adequate capacity to store settled solids for a time period based on climate, equipment, clean out frequency, and method of disposal. If animal manure, such as from dairy cows, is flushed to a storage pond, a solids separator may be provided for removing fibrous solids to facilitate pumping and irrigation. Solid separators, debris basins, etc., shall be designed to prevent seepage to the groundwater.

Water Quantity. Waste storage facilities will have an affect on the water budget. The affect will be dependent upon the size of the waste storage facility. The waste storage facility will cause an increase in evaporation and a decrease in downstream runoff where drainage is designed to enter the facility. The waste storage facility will not increase water demand at the site.

Water Quality. The waste storage facility should have an overall positive impact on water quality by storing animal waste and polluted runoff until it can be safely applied to the land. Where ponds are used for waste storage, there can be a positive effect on water related wildlife habitat by providing open water bodies. Water quality can be adversely impacted during initial construction due to erosion of the site but will be minimal using proper construction pollution prevention measures.

Other Considerations. Non-polluted runoff should be excluded from the waste storage facility to the fullest extent possible, except where its storage is advantageous to the operation of the agricultural waste management system.

Due consideration should be given to economics, the overall waste management system plan, safety and health factors.

Considerations for minimizing the potential for sudden breach of embankment or accidental release from the required volume.

Features, safeguards, and/or management measures to minimize the risk of embankment failure or accidental release or to minimize or mitigate impact of this type of failure should be considered when any of the categories listed in Table 6 may be affected.

Table 6. Potential Impact Categories from Breach of Embankment or Accidental Release
1. Surface water bodies - perennial streams, lakes, wetlands, and estuaries.
2. Critical habitat.
3. Farmstead, or other areas of habitation.
4. Off-farm property.

The following should be considered either individually or in combination to minimize the potential of or the consequences of sudden breach of embankments when one or more of the potential impact categories listed in Table 6 may be affected:

1. An auxiliary (emergency) spillway.
2. Additional freeboard.
3. Wet year rather than normal year precipitation.
4. Reinforced embankment - such as, additional top width, flattened and/or armored downstream side slopes.
5. Secondary containment.

The following should be considered to minimize the potential for accidental release of gravity outlets from the required volume when one or more of the potential impact categories listed in Table 6 may be affected:

1. Outlet gate locks or locked gate housing.
2. Secondary containment.
3. Alarm system.
4. Another means of emptying the required volume.

Considerations for minimizing the potential of waste storage pond liner failure.

Consideration should be given to providing an additional measure of safety from waste storage pond leakage when any of the potential impact categories listed in Table 7 may be affected.

Table 7. Potential Impact Categories for Liner Failure
1. Any underlying aquifer is at a shallow depth and not confined.
2. The vadose zone is rock.
3. The aquifer is a domestic water supply or ecologically vital water supply.
4. The site is located in an area of carbonate rock (limestone or dolomite).

Should any of the potential impact categories listed in Table 7 be affected, consideration should be given to the following:

1. Soil blanket lining with additional thickness.
2. Flexible membrane liner over a soil blanket liner.
3. Concrete liner.

Consideration for minimizing the impact of odors.

An anaerobic lagoon with loading rates reduced to at least one-half the values of AWMFH Figure 10-22 should be considered for sites located in rural areas where odors should affect neighboring farms having enterprises that do not cause odors and/or neighbors who earn a living off-farm.

For sites located near urban areas, the following should be considered:

1. Covering the storage facility with a suitable cover.
2. Using naturally aerated or mechanically aerated lagoons.
3. Using composting in conjunction with a solid waste system rather than a liquid or slurry system.
4. Using a methane digester and capture system.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Engineering plans, specifications, and reports shall include:

a. Plan view of system layout.

b. Type and number of animals the structure is designed to serve.

c. Storage period.

d. Structural details of components.

e. References to components supplied by others (pumps, etc.).

f. Special safety requirements.

g. Vegetative requirements.

h. Quantities.

i Drainage/Grading plan if one is needed.

j. Soil and foundation findings, interpretations, and reports.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. The waste storage facility should be inspected periodically to ensure that all components are operating as planned.

The O&M plan shall contain the operational requirements for emptying the storage facility. It shall include maximum operating levels of the waste storage facility, clean-out intervals, operation requirements of structural components, etc. The O&M plan shall include the requirement that waste shall be removed from storage and utilized in locations, times, rates, and volume in accordance with NRCS conservation practice standard, Nutrient Management, Code 590. In addition, the O&M plan for ponds shall include the requirement that following storms, waste shall be removed at the earliest environmentally safe opportunity to ensure that sufficient capacity is available to accommodate subsequent storms.

The O&M plan for stacking facilities shall require that the structure be inspected at least twice each year when the facility is empty. Any wooden parts, hardware, or other replaceable parts which are damaged or show excessive wear or decay shall be replaced. Roof structures should be examined for structural integrity. Walls of composters and dry stacks that are constructed with lumber treated to a 0.25 pcf retention level may need replacing during the life of the structure.

The waste storage facility shall be operated so as to maintain the storage capacity for the 25-year, 24-hour storm.

The embankment and other vegetated areas shall be mowed and fertilized to maintain a protective vegetative cover.

REFERENCES

-ACI 318, 360, 530
-Alabama Poultry Waste Management - Waste Utilization and Facilities Design Workbook
-ASTM D-653, D-698, D-2488
-ASAE Specifications: EP378.3, EP393.2, EP288.5, S288
-NEH, Part 651, Agricultural Waste Management Field Handbook, Chapter 7 and 10.
-Basic Building Code, 12th Edition
-Federal Specification, Wood Preservation: Treating Practices, TT-W-571i.
-"Manual of Steel Construction", American Institute of Steel Construction.
-"National Design Specifications for Wood Construction", American Forest and Paper Association.
-National Engineering Manual, Part 520
-NRCS Conservation Practice Standards:
  Critical Area Planting, Code 342
  Fence, Code 382
  Nutrient Management, Code 590
  Pond, Code 378
  Pond Sealing or Lining, Code 521
  Waste Treatment Lagoon, Code 359
-Technical Release - TR-74

CONSTRUCTION SPECIFICATION
FOR
313 - WASTE STORAGE FACILITY

SCOPE

This specification shall consist of the clearing, grubbing, excavation, backfill, concrete, forms, reinforcing steel, timber, trusses, sheet metal, fasteners, other appurtenances and services required for the construction of waste storage or waste conveyance structures (i.e., waste storage ponds, dry stacks, composters, tanks, flumes, etc.) and the disposal of all cleared and excavated materials. Construction shall be carried out in such a manner that erosion, water, air, and noise pollution will be minimized and held within legal limits as established by state and federal regulations.

All structures shall be constructed according to plans furnished by the Natural Resources Conservation Service (NRCS) and in accordance with the NRCS's engineering standards for these practices, as well as local building codes and current industry standards. Any deviation from the approved drawings and specifications must be approved by the engineer prior to construction.

SPECIFICATIONS FOR WASTE STORAGE PONDS

Clearing

All trees, brush, and stumps shall be removed from the site and spoil areas before excavation is performed. All material cleared from the area shall be disposed of by burning or removing from the site and stacking. All burning shall conform to regulations of Alabama state law.

Excavation

The completed excavation, berms, and placed banks (spoil disposal) of unsuitable material shall conform to lines, dimensions, grades, and slopes shown on the plans or staked on the site to the degree that skillful operation of the excavating equipment will permit. Runoff from outside drainage areas will be diverted away from the waste storage pond.

Borrow material shall be obtained from within the storage pond site as much as practical. The bottom of the pond shall be as uniformly flat as possible. Any changes in slope of the pond bottom will be approved by the engineer responsible for design. Any excess borrow material will be disposed of by: (1) raising the height of or widening the embankments or by flattening the slopes; (2) blending with the diversion or levee; or (3) hauling away.

Dike or Levee Construction

The placing and spreading of fill material shall be started at the lowest point of the foundation and shall be brought up in approximately horizontal layers not exceeding 9 inches in thickness before compaction. These layers shall be of approximately uniform elevation and shall extend over the entire area of fill. Construction equipment will be operated over the area of each layer in a manner that will result in a specified degree of compaction and a watertight structure. Special construction equipment will be used when the required compaction cannot be obtained by routing of the construction equipment. Construction of the fill shall be undertaken only at such times that the moisture content of the fill material will permit satisfactory compaction. If the material is too dry, or too wet, the fill material shall be manipulated (adding water, drying, disking, etc.) to obtain the desirable moisture content.

Inlet and Outlet Structures

Inlet and outlet pipes, flumes, and troughs shall be placed to the lines and grades shown on the plans.

Ramp Installation

When used, an inlet ramp shall be constructed to the dimensions, lines, and grades shown on the plans or as otherwise specified.

Materials

All of the component parts of the inlet and outlet pipes and supports, ramps, fences, and other materials shall be specified on the plans and shall be installed in a workmanlike manner. Concrete for flumes shall be as specified below.

Concrete

This work shall consist of furnishing, forming, placing, finishing, and curing Portland cement concrete as required in the construction of the work. When concrete is used, the mixture shall be no less than a 5-bags-per-yard mix. Water content shall not exceed 6.0 gallons per sack. Concrete will be thoroughly rodded or vibrated to remove voids and densify the concrete.

Small batch mixture shall be as follows: A standard brand Type 1 Portland cement, washed sand, and gravel. Clean water shall be used in the mix. [Suggested ratio of aggregates in mix: 94 lb. cement (1 bag), 6 gal. water, 170 lb. clean dry sand, 315 lb. dry gravel. Smaller batches: 1 part cement, 2 parts sand, and 3 parts gravel, and water at the rate of 1 gal. per 16 lbs. of cement.]

Concrete shall not be placed when the atmospheric temperature may be expected to fall below 40^{o}F at the time concrete is delivered and placed at the work site.

All exposed surfaces of concrete shall be protected from the direct rays of the sun for at least the first 7 days. All concrete shall be cured by keeping it continuously moist for at least 7 days after placement. This moist curing can be accomplished by spraying with two coats of curing compound when other concrete will not be bonded to the treated surface.

Vegetation

Vegetative treatment shall be established as specified or as shown on the plans. Vegetation shall be applied as critical area planting and will include seedbed preparation, seeding, liming, fertilizing, and mulching.

Fencing

The waste storage pond shall be fenced when all construction work is completed. Permanent fencing shall be installed as specified in the plan with safety as the objective. A **"WARNING"** sign (90 in.^{2} minimum) shall be placed on each straight section of fencing, not to exceed a spacing of 300 feet, to alert the public to the hazards of the waste storage pond.

SPECIFICATIONS FOR WASTE STORAGE STRUCTURES

Clearing and Grubbing

All trees, brush, stumps, boulders, rubbish, and manure shall be removed from the foundation, storage, and spoil area(s) before excavation is performed. All material cleared from the area shall be disposed of by burning or burying on-site or hauling to an appropriate landfill. All burning shall conform to state and federal laws and regulations. Trees and other cleared vegetation will be cut flush with the ground surface in spoil areas. The foundation and/or storage area will have all stumps, roots, and vegetation removed. The general area around buildings will also require grubbing as necessary to complement the use intended for the structure. The limits of this grubbing will be staked by the engineer or his/her agent.

Excavation

Top soil excavated from the site will be stockpiled for later placement around the completed structure. Soils containing excessive organic material will be removed from the foundation area. The completed excavation and placement of spoil material shall conform as nearly to lines, dimensions, grades, and slopes shown on plans or staked on the ground as skillful operation of the excavating equipment will permit. Generally, spoil will be placed and spread to blend with the existing terrain of the spoil area. Runoff from outside drainage areas will be diverted from the excavation area.

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased as necessary to provide space for sheeting, bracing, shoring, and other supporting installations. When the work is completed, such supporting installations shall be removed.

Fill

Placement - Earth material placed for pads, flooring, or foundations shall be good sandy clay or clayey sands and gravels free of detrimental amounts of sod, roots, large stones, and other

objectionable material. Highly plastic clay soils should be avoided.

Begin placing and spreading the fill material at the lowest point of the foundation and construct the fill in approximately horizontal layers not exceeding 8 in. loose thickness unless otherwise specified. These layers shall be reasonably uniform in thickness and shall extend over the entire area of the fill. Operate the earth hauling or compacting equipment over each layer so that reasonable compaction of the fill material will be obtained. A minimum of four complete passes over each layer by the compacting equipment is required to obtain adequate compaction.

If a minimum required density is specified, each layer of fill shall be compacted as necessary to obtain that density. Special equipment shall be used if needed to obtain the required compaction.

All finished work shall be left in a neat and sightly condition. The outer edges and slopes of the fill shall blend with the surrounding landscape and complement the structure built upon it.

Moisture Control - All fill material shall have a moisture content sufficient for the required compaction. Fill material which is too dry shall be moistened by adding water or by thoroughly mixing with moist fill until an acceptable moisture level is obtained. Fill material which is too wet shall be allowed to dry out naturally or shall be dried by disking or shall be thoroughly mixed with dry fill material until an acceptable moisture level is obtained.

The moisture content of the fill shall be maintained within the limits to:

1. Prevent bulking or dilatence of the material under the action of the hauling or compacting equipment.

2. Prevent adherence of the fill material to the equipment.

3. Ensure the crushing and blending of the soil clods and aggregation into a homogeneous mass.

4. Contain adequate moisture so that a sample can be hand molded without the mold oozing through the fingers or squeezing out any water.

Timber Fabrication and Installation

Above ground timber structures, such as litter dry stack facilities, shall be constructed on a firm foundation to the lines and grades shown on the plans. Dimensions and spacings shown on the plans and drawings are minimum requirements for the 25-year wind and snow loads. These dimensions and spacings may be altered if the result is a stronger structure, with prior approval of the engineer. In no case will the dimensions and spacings be modified in a way which would reduce the strength of the structure. All framing shall be true and exact. Timber shall be accurately cut and assembled to a close fit.

Appropriate bracing for safety and structural stability during construction shall be used.

Wood and Timber - All material shall be sound wood, free from decay, and of new quality. Good quality, used, pressure-treated lumber may be utilized for walls of composter bins and dry stack storage areas. All timber beams shall be dense, structural quality, and graded in accordance with the Standard Grading Rules for Southern Pine Lumber. Unless otherwise specified, all timber and lumber shall be furnished in American Standard dressed sizes. All sizes specified are nominal sizes.

All structural timber, posts, poles, and lumber, except roof girders, rafters, purlins, trusses, knee braces, and attic bracing shall be pressure treated. Treated timber and lumber shall be impregnated with the specified type and quantity of preservative and conform to Federal Specification TT-W-571. The minimum net retention of the common preservative, chromated copper arsenate, shall be 0.4 lbs/cf(pcf) for dimension lumber used above ground and 0.6 pcf for structural posts or timbers in contact with the ground. Lumber used for walls of composting bins and dry stack storage areas may be treated to a 0.25 pcf level.

Posts and poles shall be set plumb and to the depths shown on the drawings. Backfill around posts/poles shall be concrete or hand-tamped earth as shown on the drawings. Posts/poles shall be temporarily braced until girders, plates, or other members are installed to maintain plumb alignment.

Handling and Storing - All timber and lumber stored at the site of the work shall be neatly

stacked on supports at least 12 in. above the ground surface and protected from the weather by suitable covering. Untreated material shall be so stacked and stripped as to permit free circulation of air between the tiers and courses. Treated timber may be close-stacked. The ground underneath and in the vicinity of all stacks shall be cleared of weeds and rubbish. The use of cant hooks, peaveys, or other pointed tools, except end hooks, will not be permitted in the handling of structural timber or lumber. Treated timber shall be handled with rope slings or other methods which will prevent the breaking or bruising of outer fibers, or penetration of the surface in any manner.

Fasteners - Connections between wood members requiring bolts may be initially done with appropriately sized nails until such time as it is expedient to add the bolts, unless specified otherwise in the drawings. Bolts shall be added as soon as practicable, before the building is declared structurally sound, and before being accepted as complete. Nails and spikes shall be driven with just sufficient force to set the heads flush with the surface of the wood. Holes for machine bolts shall be bored with a bit of the same diameter as the bolt. Appropriately sized washers shall be used in contact with all bolt heads and nuts that would otherwise be in contact with the wood.

Pressure treated lumber does not hold nails as well as untreated lumber because the preservatives act as a lubricant. Spiral or annular ring shank nails shall be used in these connections because they have a higher withdrawal resistance. Nails to fasten rafters, girders, cleats, scabs, wooden sidewalls, and/or braces to the pressure treated poles shall be 20d to 40d size or as specified on the drawings. Untreated framing members shall be fastened to each other with 16d to 20d nails. Examples include roof purlins to rafters, and tie-down cleats or braces to rafters or girders. Various galvanized metal fasteners, with appropriate joist or deck nails, may be used to facilitate assembly, as approved by the engineer. All bolts, washers, nuts, nails, and other hardware exposed to rain or animal wastes shall be galvanized unless otherwise specified.

Trusses - Trusses may be metal or wood and shall be designed to handle the roof loads specified in the construction details and shall be installed on the spacing compatible with the design. Trusses shall have a minimum of 12 in. of overhang and more overhang is advisable. Trusses may be pre-fabricated, manufactured trusses. Used wooden trusses will not be allowed unless a new truss certification is provided by a registered professional engineer.

Manufactured trusses will be installed in accordance with the manufacturer's instructions. All trusses will be of a design approved by a registered professional engineer. A copy of the truss certification shall be provided to the NRCS approving authority prior to truss installation.

Truss anchorage and associated supports shall be as shown on the drawings or other acceptable methods as approved by the engineer.

Roofing - Roofing shall be galvanized metal in standard lengths and widths and shall be of new quality (without holes, rust, etc.). Roofing material shall be minimum 29 gauge and be ribbed for strength. Roofing shall be installed in accordance with manufacturer's recommendations. If any other type of roofing material is desired, it must first be approved by the engineer. Nails used to attach roofing material to the purlins shall be lead-headed nails, aluminum nails with neoprene washers, or other type as approved by the NRCS approving authority.

Steel Reinforcement

Reinforcement steel and welded wire fabric shall be new, clean, and free of oil, grease, paints, and flakey rust. Steel bars for concrete reinforcement shall be deformed billet-steel bars, conforming to ASTM Specification A-615, Grade 40 or 60. Welded wire fabric shall conform to the requirements of ASTM Specification A-185.

Reinforcement steel shall be accurately placed as specified and secured in position in a manner which will prevent its displacement during placement of the concrete. If reinforcing steel is spliced, the splices shall provide an overlap equal to 30 times the diameter of the smaller bar in the splice and shall be tied at both ends of the splice. Steel reinforcement in concrete block walls shall be tied in place prior to laying the blocks. Dropping or placing required steel reinforcement into the holes of concrete blocks

without properly overlapping and tying the steel together with the foundation steel is not acceptable. Field bending of steel will be permitted. Heating of steel for bending will not be permitted.

Reinforcement steel and welded wire fabric shall be suspended off the ground and other concrete contact surfaces by using scotches of concrete bricks, concrete blocks or pieces of blocks, wire stands, or other approved method prior to the placing of concrete. Scotches of stones, wood materials, earth, earth clods, clay bricks, scrap metal and other unapproved materials are not acceptable. During concrete placement welded wire reinforcement shall be pulled into the middle of the concrete or the position shown in the drawings. Unless otherwise specified, welded wire fabric shall be spliced in the following manner:

Adjacent sections shall be spliced by overlapping a minimum of six inches, or one full mesh plus 2 inches. whichever is greater. The splice length shall be measured from the center of the first transverse wire in one piece of fabric to the center of the first transverse wire in the lapped piece of fabric.

Concrete

Design Mix - The concrete mixture shall be no less than 5-bags-per-yard mix. The water content shall not exceed 6 gal. per bag of cement in the mixture; however, the concrete mixture may be a similar mix selected from the "Master Proportion" table in the State of Alabama Highway Department Standard Specifications for Highway Construction, 1992 Edition. Any mix selected shall have a designed minimum 28 day compressive strength of 3,000 pounds per square inch (psi). The concrete shall contain a standard known brand of Portland cement with washed sand and gravel. Clean water shall be used in the mix. Calcium Chloride and other chemical admixtures for concrete will not be accepted unless expressly specified in the drawings or specifications.

Consistency - The amount of water used in the concrete shall be the minimum necessary to obtain the required workability. The consistency of the concrete shall be such that it can be worked readily into the corners and angles of the forms and around reinforcement but without permitting the materials to segregate or excess free water to collect on the surface. The slump shall be between 2 and 5 in. as tested by "The Test for Slump for Portland Cement Concrete", ASTM Specification C-143.

Fiber Reinforced Concrete - Fiber shall consist of 3/4" length virgin homopolymer polypropylene fibers, either the collated fibrillated type or the monofilament type. The minimum rate of application is 1.5 lbs. of fiber per cubic yard of concrete.

The addition of fiber to a concrete mix may cause an apparent reduction in slump. However, no additional water shall be added to the mix to improve workability. If needed, a suitable plasticizer should be added to the concrete mix. During placement the fiber mix will generally require more effort and vibration to move the mix and consolidate it into the forms due to the lower slump nature. Properly controlled internal vibration is acceptable, but external vibration of the forms and exposed surfaces is preferable to prevent fiber segregation.

If welded wire fabric is omitted from concrete slabs and only fiber additives are used, contraction joint spacing will be reduced from a maximum of 30 ft. to a maximum of 15 ft. in any direction. Sawn joints shall be 1/4 of the slab's thickness in depth. Formed joints shall be of a keyway type. Smooth vertical joints through the slab are not permitted.

Fiber additives in concrete does not take the place of structural steel reinforcement. Where steel reinforcement is shown on drawings it shall be placed as shown.

Forms - Forms shall be of wood, steel, or other approved material. Forms shall be true to line and grade, mortar tight, and sufficiently rigid to prevent objectionable deformation under load. Form surfaces shall be smooth, free from irregularities, dents, sags, or holes when used for permanently exposed surfaces. Rods used for internal ties shall be so arranged that, when the forms are removed, metal will not be less than 1 in. from any concrete surface. Forms for walls and vertical sections 2 ft. high and taller shall be stabilized with adequate tie rods, walers, cat-heads, and sufficient bracing to prevent

shifting or movement of forms during placing of concrete.

Forms for exposed surfaces shall be coated with a non-staining form release agent which shall be applied before the concrete is placed. All excess release agent on the form surfaces and any on surfaces requiring bonding with concrete shall be removed.

All form removal shall be accomplished in such a manner as to prevent injury to the concrete. Forms for floor slabs and such work may be removed after a minimum of 24 hours. Forms for walls shall be left in place for a minimum of three days. All forms must be removed before final inspection of the work. All repair work must be done immediately after removal of forms.

Timing and Temperature - Concrete shall be placed within 1-1/2 hours after introduction of water to the cement and aggregates. Concrete shall not be placed when the outside temperature is expected to fall below 40°F at the time the concrete is delivered and placed at the work site. Concrete shall not be exposed to freezing temperatures during the curing period. Concrete, when deposited in the forms during hot weather, will have a temperature not greater than 90°F at the time of placement. Ice may be used as a portion of the mixing water to control temperature provided all ice is melted in the mixing process. When the outside temperature reaches or exceeds 90°F., the concrete shall be placed within 45 min. after batching.

Conveying and Placing - No concrete shall be placed until the approving official has given approval of the in-place subgrade, forms, reinforcing steel, and any other items involved or affected by the concrete placement.

Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods which will prevent segregation or loss of ingredients by using hoppers and chutes, pipes, or "elephant trunks". There shall be no vertical drop greater than 5 feet.

Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, standing and running water, and never upon soft mud, dried porous earth, or fill that does not meet specified compaction requirements. Soft mud or other unacceptable foundation material shall be removed and replaced with gravel or other approved material.

Concrete shall be deposited as close as possible to its final position in the forms. Concrete shall be thoroughly consolidated by rodding or mechanically vibrating the concrete in place supplemented by hand-spading and tamping to remove air voids. Vibrating equipment shall be used when pouring walls and other thin sections.

Concrete floor slabs may be placed at one time or may be poured in sections at different times. When steel reinforcement is specified for the floor slab, formed contraction joints shall be placed at intervals not to exceed 30 ft. in any direction unless otherwise specified. When steel is not used, joints shall be as specified under Fiber Reinforced Concrete. The formed edges of each section shall be keyed to lock the edges of adjacent sections together. The edge forms may be removable metal or wood forms having the required keyed shape or may be thin galvanized metal designed to be left in place. Smooth vertical edged joints will not be allowed.

Finishing - Defective concrete, honeycombed areas, voids left by the removal of tie rods, and unacceptable ridges left on concrete surfaces shall be repaired immediately after the removal of forms unless otherwise authorized and directed. Voids left by the removal of tie rods shall be reamed and completely filled with mortar.

Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be secured with keys, dovetails or anchors. Excessive rubbing of formed areas will not be permitted. All unformed surfaces of concrete, exposed in the completed work, shall have a wood float finish without additional mortar.

Curing - Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. All exposed surfaces of concrete shall be protected from the direct rays of the sun for at least these first 7 days. All concrete shall be cured by keeping continuously moist for the entire curing period, or until curing compound is applied. Moisture shall be maintained by sprinkling, flooding, fog spraying, or by covering with materials kept continuously moist such as canvas, cloth mats, straw, sand, polyethylene, or other approved material. Wood forms (except plywood) left in place during the curing period shall be kept wet. Formed surfaces shall be

thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

If a curing compound is used, two coats of it will be applied to all concrete surfaces except construction joints and surfaces to which other concrete will be bonded. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs, and finishing of that surface are completed. Curing compound shall meet the requirements of ASTM Specification C-309, Type 2, white pigmented.

Landscaping and Vegetation

The area adjacent and in the immediate vicinity of the structure shall be shaped to blend with the natural surroundings and to complement the structure and work area around it. Shaping shall be in such a way as to drain or divert all overland and roof runoff safely away from the structure and surrounding work area. All disturbed areas around the structure, including spoil areas, shall be vegetated and/or surfaced with gravel, chert, or some other acceptable covering as permitted by the NRCS approving authority. Spoil areas not used for farm traffic shall be vegetated.

Permanent vegetation will be established to the plant species and by methods prescribed by the approving official. All vegetating of disturbed areas will be done as critical area planting and shall include liming, fertilizing, seedbed preparation, seeding and mulching. Temporary vegetation may be used when conditions or seeding dates are not suitable for the establishment of permanent vegetation. Disturbed areas shall be mulched regardless of seeding dates.

If farm animals have access to the vegetated area, it will be appropriately fenced until vegetation is well established.